



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.06.2011 Bulletin 2011/26

(51) Int Cl.:
B62D 33/067 (2006.01)

(21) Application number: **09425534.6**

(22) Date of filing: **24.12.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

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(54) **Device for the controlled tilting of driver's cabin of a vehicle**

(57) Device (D) for the controlled tilting of the driver's cabin (C) of a transport vehicle, of the type comprising actuator means (4) acting on said cabin (C) in order to allow the rotation of the cabin (C) itself around a horizon-

tal axis (3); said actuator means (4) comprise motor means (5, 8, 9) and belt means (10,11) fixed in correspondence of at least a front part (CA) of said cabin (C) and suitable to wrap around said motor means (5,8,9).

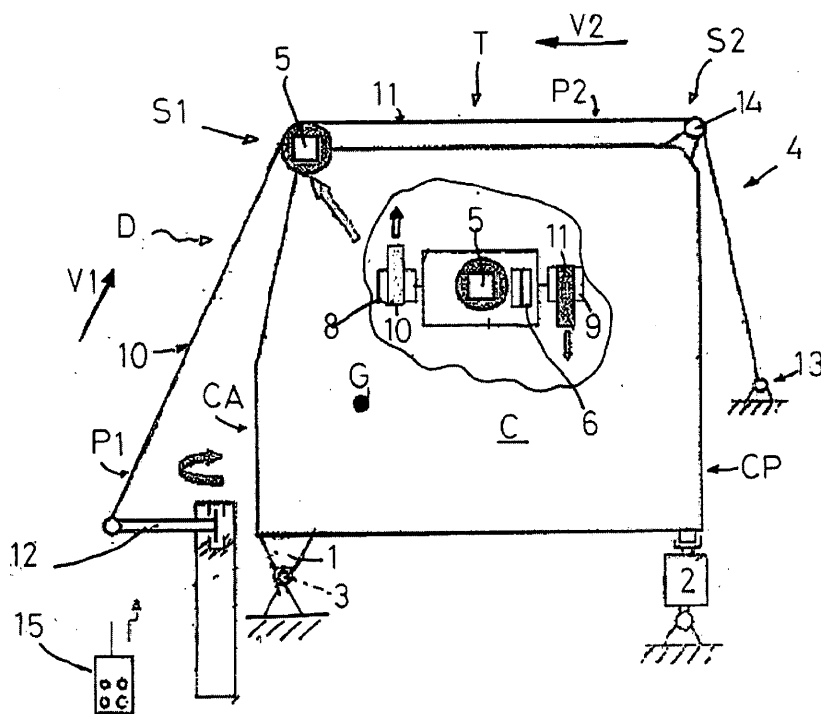


FIG. 2

Description

Application field of the invention

[0001] The present invention relates to a device for the controlled tilting of a driver's cabin of a vehicle.

[0002] In particular, the invention is advantageously used for facilitating the controlled tilting of the driver's cabin, in order to allow the direct access to the engine compartment of a transport vehicle, such as, in non-limitative examples, a truck or similar used for commercial or industrial transport, or as a specialty vehicle such as a fire-fighting vehicle.

Description of the prior art

[0003] In the field of commercial or industrial transport or of specialty vehicles, it is known in the art to use vehicles whose driver's cabin is placed over the engine compartment and is mounted so that it can be tilted, generally in a forward direction around a horizontal axis or pivot that is parallel to the front axle, in order to allow an easy and fast access to the engine, during the maintenance operations with the vehicle stationary.

[0004] At present, the controlled tilting of the driver's cabin is performed by means of one or two hydraulic cylinders, which are usually fixed, by one end, to a side point of the bottom of the driver's cabin, and, by the opposite end, to the vehicle frame, in order to provoke the cabin tilting by rotating it up to a predetermined limit angle of elevation which corresponds to the maximum allowed tilting. The cylinders may be manually operated or, preferably, they may be operated by means of an appropriate electric motor.

[0005] The dimensions of such cylinders must necessarily be such that they can bear the weight, that is usually high, of the driver's cabin.

[0006] Moreover, it is necessary that the driver's cabin is reinforced in correspondence of the point where the cylinder is fixed, in order to bear the thrust forces exerted by the cylinder itself, and the dynamic stress drop, which contributes to a further increase the weight of the cabin itself, and which often causes structural twists of the cabin, especially on the side where the cylinder is present, when it is the only one.

Summary of the invention

[0007] The aim of the present invention is therefore to overcome the drawbacks of the prior art described above.

[0008] In particular, an aim of the present invention is to provide a device suitable for the controlled tilting of the driver's cabin of a transport vehicle, which is light and easily applicable to the solutions known in the art.

[0009] A further aim of the present invention is to provide a device which facilitates the tilting of the driver's cabin of a transport vehicle by means of a dual dynamic action up to the maximum angle of elevation.

[0010] According to the present invention a device for tilting the driver's cabin of a transport vehicle is realized, of the type comprising actuator means acting on said cabin in order to allow the rotation of the cabin itself around a horizontal axis; the device being characterized in that said actuator means comprise motor means and belt means operating in correspondence of the profile of said cabin and suitable to wrap around said motor means.

[0011] The subject of this invention is in particular a device for the controlled tilting of the driver's cabin of a vehicle, and respective vehicle, as described more fully in the claims, which are an integral part of this description.

Brief description of the Figures

[0012] The technical details and the advantages of the invention, according to the purposes mentioned above, will become more clear from the following detailed description given with reference to the figures attached hereto in which a preferred but non-limitative embodiment of the device, together with alternative embodiments, are shown, in which:

- figure 1 is a schematic view, with some parts removed for the sake of clarity, of a preferred embodiment of the device according to the invention applied to a driver's cabin of a transport vehicle, with an enlarged view of a first alternative embodiment of a detail;
- figure 2 shows a perspective schematic view in an enlarged scale of a detail of the device shown in figure 1;
- figure 3 shows a diagram of the forces developed during the tilting of the cabin, and an enlarged view of the pivot around which the cabin rotates;
- figure 4 shows a perspective schematic view in an enlarged scale of an alternative embodiment of the device shown in figure 2.

[0013] In the drawings the same reference numbers and letters identify the same elements or components.

Detailed description of preferred embodiments of the invention

[0014] With reference to the attached figures, D generally indicates a device suitable for determining the controlled tilting of a driver's cabin C of a transport vehicle, in order to allow, for example, the access to the engine compartment (known in the art and not shown) that is placed underneath.

[0015] According to what is shown in figure 1, the cabin C, starting from its normal position (indicated by a continuous line) with the rear part CP being fixed to and resting on a retainer 2 fixed to the frame, can be tilted around a horizontal axis or pivot 3, mounted on an appropriate support 1 in correspondence of the front part CA of the cabin C itself, under the thrust of actuator means which

are part of the device D and which are schematically indicated by 4 in figure 1.

[0016] According to what is shown in figure 2, with particular reference to the enlarged view, the actuator means 4 are suitable to act on the cabin C, and comprise in detail: an electric motor 5 connected to a pair of winches 8 and 9, which are mounted in correspondence of a corner S1 of an external part, preferably, but not limited to, a front part, of the roof T of the cabin C.

[0017] The winches 8 and 9 are reciprocally disposed on the opposite side with respect to the electric motor 5 itself, and operate in opposite directions with respect to each other, for example by acting on an appropriate remote control 15: they rotate around their own axis of rotation, under the thrust of the motor 5.

[0018] According to what is shown in figure 2, the actuator means 4 further comprise a first driving belt 10 whose first end is fixed to the winch 8, and is partially wrapped around the winch 8 itself, while the opposite end is fixed to a rod 12, preferably mounted in correspondence of the front part CA of the cabin C. A first end of second driving belt 11 is fixed to the winch 9, partially wrapped around the winch 9 itself, while its opposite end is constrained to a fixed support 13 on the frame of the mentioned vehicle, in correspondence of the rear part CP of the cabin C.

[0019] Thus, as it can be seen in figure 2, each belt 10, 11 defines a respective slip path P1, P2 around the external profile of the cabin C according to the respective traction direction V1, V2, V1 being opposite to V2, under the thrust of the respective winches 8 and 9: the path P1 is linear, while the path P2 is substantially L-shaped because of the presence of a pair of diverting pulleys 14 placed in correspondence of a corner S2 of an external rear part of the cabin roof C.

[0020] In order to compensate for the different lengths of the belts 10 and 11 during the controlled tilting of the cabin C, the actuator means 4 may be provided by a differential gear 6 coupled to the motor 5.

[0021] The device D further comprises spring elastic means 7 acting and disposed on the mentioned pivot 3 and suitable for facilitating the tilting of the cabin C which is performed by means of the aforementioned actuators 4 around the horizontal pivot 3 itself.

[0022] Specifically, the elastic means 7 are appropriately loaded so that they can assist the thrust of the actuators 4, with the belt 10 pulling (towards V1) and wrapping around the winch 8, for the forward tilting of the cabin C, namely by facilitating the counterclockwise rotation shown in figure 1 (arrow K) of a barycenter point G of the cabin itself in order to reach the neutral position G', in which the cabin C (in position C' indicated by a dotted line in figure 1) is in a position of unstable equilibrium, having G' vertically aligned with the pivot 3.

[0023] In addition to such position of equilibrium and up to the limit angle of elevation, namely in a point G'' in addition to G', during the rotation according to the sense of the arrow K, the elastic means 7 are suitable to oppose

to a further rotation of the cabin C, in combination with the restraining action performed by the actuators 4, with the belt 11 pulling (towards V2, opposite to V1) and wrapping around the winch 9.

[0024] With reference to figure 3, FA indicates the trend of the overall force to be exerted for tilting the cabin as a function of the tilting angle α . As it can be seen, when $\alpha = 0$ (cabin at rest) the force to be exerted is maximum. Then the force decreases up to the value 0 for $\alpha = \alpha(G')$ in the point of unstable equilibrium, after that it inverts the direction for angles $\alpha > \alpha(G')$, up to the maximum tilting at the value F_a corresponding to the angle $\alpha - \alpha(G')$. An equivalent representation can be seen in figure 3 showing an enlarged view of the pivot point 3. On the other hand, FB indicates the force trend of the spring elastic means 7, which is equivalent to FA but has the opposite sign. The way the elastic means 7 are loaded has to be pointed out. In the cabin neutral position $\alpha(G')$, the force F_B has value zero and it is loaded in a direction up to the maximum value F_B when the cabin goes down to the position at rest for $\alpha = \alpha(G)$, while it is loaded in the opposite direction up to the value F_b when the cabin is in the tilted position for an angle $\alpha = \alpha(G')$. Such loading occurs without any need for external energy, being determined just by the cabin's weight. In absolute value, $FA > FB$, therefore for tilting the cabin it is necessary to apply a further force contribution F_c by the actuator means 4, whose value must be higher than the difference $FA - FB$.

[0025] According to what is shown in the enlarged view of figure 1, the elastic means 7 preferably comprise, but are not limited to, a leaf spring 7 of the single-leaf type with folded ends. According to further alternative embodiments, the spring means 7 may comprise a leaf spring of the folded multi-leaf type, or a helical spring, or a torsion bar spring.

[0026] In all the possible alternative embodiments, the person skilled in the art is able to choose the type and the dimensions of the spring.

[0027] In a further alternative embodiment shown in fig. 4, two electric motors can be present 5', 5'' with their respective belts 10', 11' wrapped and unwrapped in opposite directions. For example a motor 5' is fixed on a retractable rod 12, or on a first end 14' of the cabin's profile, and another motor 5'' is fixed to the end 14 of the cabin's profile, or on a fixed point on the frame. The belt 10' wraps and unwraps between the motor 5' and the end 14', while the belt 11' wraps and unwraps between the motor 5'' and the end 13.

[0028] The electric motor 5' may be replaced by a crank for manually operating the respective winch. In this case the end 14' is provided with spring means, for example a torsion spring, which is loaded during the tilting operation.

[0029] The electric motor 5' may be replaced by a torsion spring which is loaded during the tilting operation. The cabin return is then determined by this spring pulling on the belt 11', when the motor or the crank 5' rotates in

the opposite direction and releases the belt 10'.

[0030] Further alternative embodiments may include motor means, like the aforementioned ones, on both sides of the cabin.

[0031] It is worth noting that the mentioned rod 12 can be retractable under the cabin C, as well as all the aforementioned components of the actuators 4 can be integrated or hidden in the structure of the cabin C itself. By introducing the aforementioned actuators 4 and the elastic means 7 acting and disposed on the pivot 3, the device D according to the invention generates the following advantages:

- recovery of the kinetic energy deriving from the weight of the cabin C,
- replacement of the hydraulic or pneumatic cylinder used in the solutions of the prior art with more efficient and lighter means,
- reduction of the overall weight of the cabin C,
- easier and faster tilting and repositioning of the driver's cabin C in its normal position.

[0032] The invention thus contrived can be subjected to numerous variations or modification, without departing from the scope of the invention; moreover all the details may be replaced by others technically equivalent.

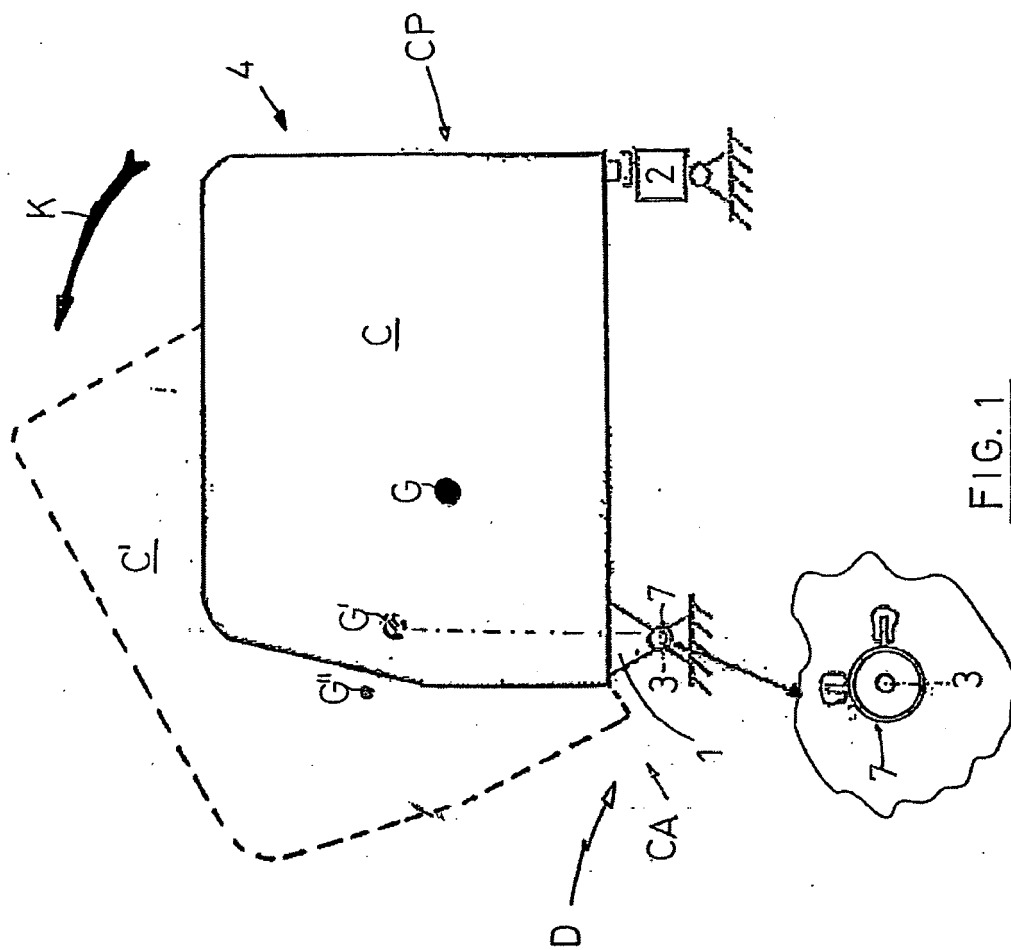
[0033] From the description set forth above it will be possible for the person skilled in the art to embody the invention with no need of describing further construction details.

Claims

1. Device (D) for the controlled tilting of the driver's cabin (C) of a transport vehicle, of the type comprising actuator means (4) acting on said cabin (C) in order to allow the rotation of the cabin (C) around a horizontal axis (3); the device being **characterized in that** said actuator means (4) comprise motor means (5, 8, 9) and belt means (10, 11) acting in correspondence of the profile of said cabin (C) and suitable to wrap around said motor means (5, 8, 9).
2. Device according to claim 1, wherein said motor means comprise winch means (8, 9) coupled with respective motors (5) in order to determine the rotation of said winch means (8, 9).
3. Device according to claim 2, wherein said belt means (10, 11) comprise at least a first belt (10) fixed to a front portion of said cabin (C) and wrapped around at least a first winch (8), and at least a second belt (11) fixed to a point of the vehicle frame (13) on the rear side (CP) of said cabin (C) and wrapped around at least a second winch (9).
4. Device according to claim 3, wherein said at least

first and second belt (10, 11) are suitable for externally defining respective slip paths (P1, P2) around said cabin (C) in respective opposite traction directions (V1, V2).

5. Device according to claim 4, wherein said winch means (8, 9) are placed in correspondence of at least one corner (S1) of an external part of the roof (T) of said cabin (C).
6. Device according to claim 5, wherein an end of said at least first belt (10) is fixed in correspondence of at least a rod (12) connected to said front part (CA), an end of said at least second belt (11) being fixed in correspondence of at least a support (13) that is fixed in correspondence of said rear part (CP).
7. Device according to claim 5, wherein an end of said at least first belt (10) is fixed in correspondence of at least a front cabin support (14'), while another end can be wrapped on said first winch placed on a rod (12) connected to said front part (CA), an end of said at least second belt (11) being fixed in correspondence of at least a support (13) that is fixed in correspondence of said rear part (CP).
8. Device according to claim 2, **characterized in that** said motors (5) are electric motors, possibly being coupled with at least a differential gear (6).
9. Device according to claim 2, **characterized in that** said motors (5) are a manually operated crank of the respective winch.
10. Device according to claim 2, **characterized in that** said motors (5) are a torsion spring that is loaded during the tilting.
11. Device according to any of the previous claim, wherein elastic means (7) are suitable to act on said axis (3) in order to facilitate said tilting in combination with said actuator means (4).
12. Device according to claim 10, wherein said elastic means (7) comprise a leaf spring with at least a single leaf, or helical spring means, or torsion bar spring means.
13. Transport vehicle, in particular for commercial or industrial transport, or specialty vehicle, **characterized in that** it comprises a device for tilting the driver's cabin according to one or more of the previous claims from 1 to 11.



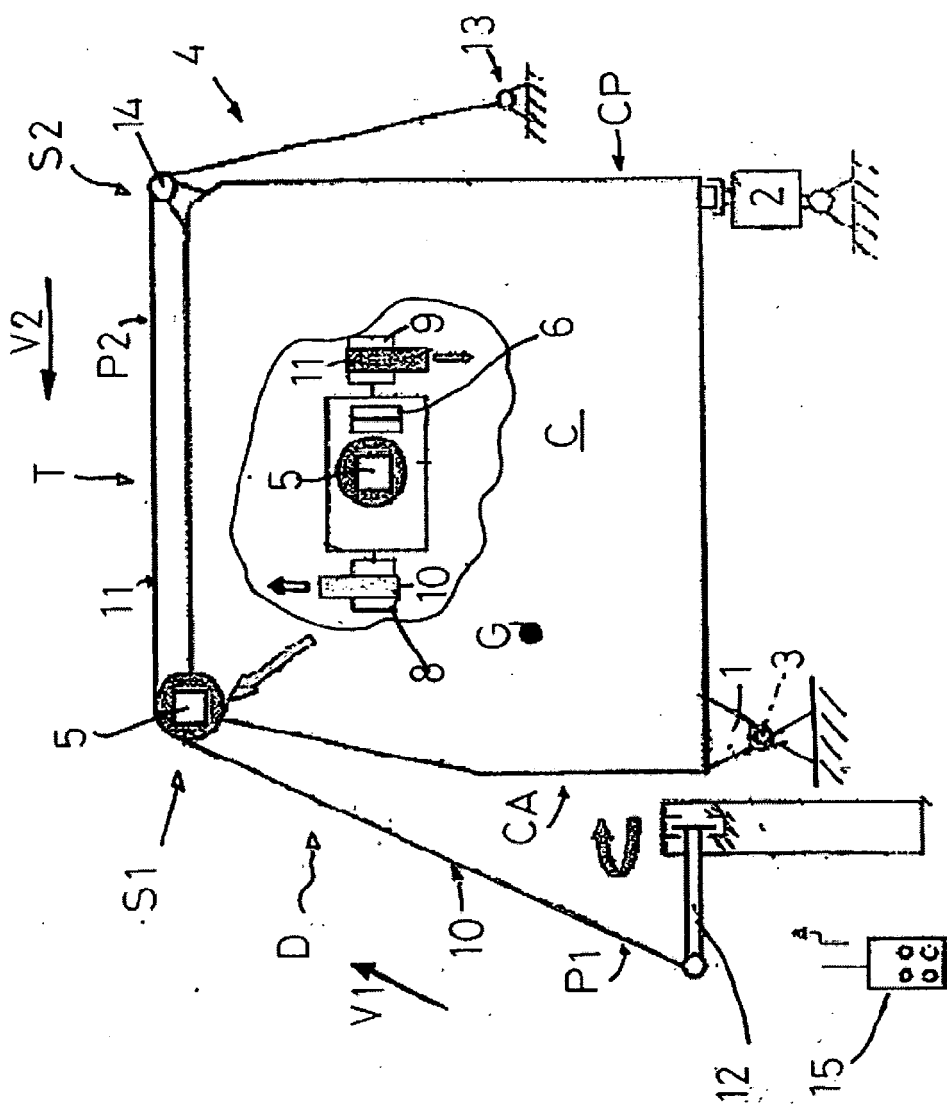


FIG. 2

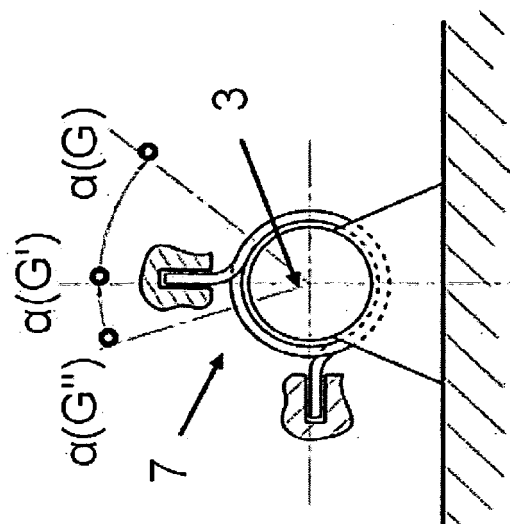
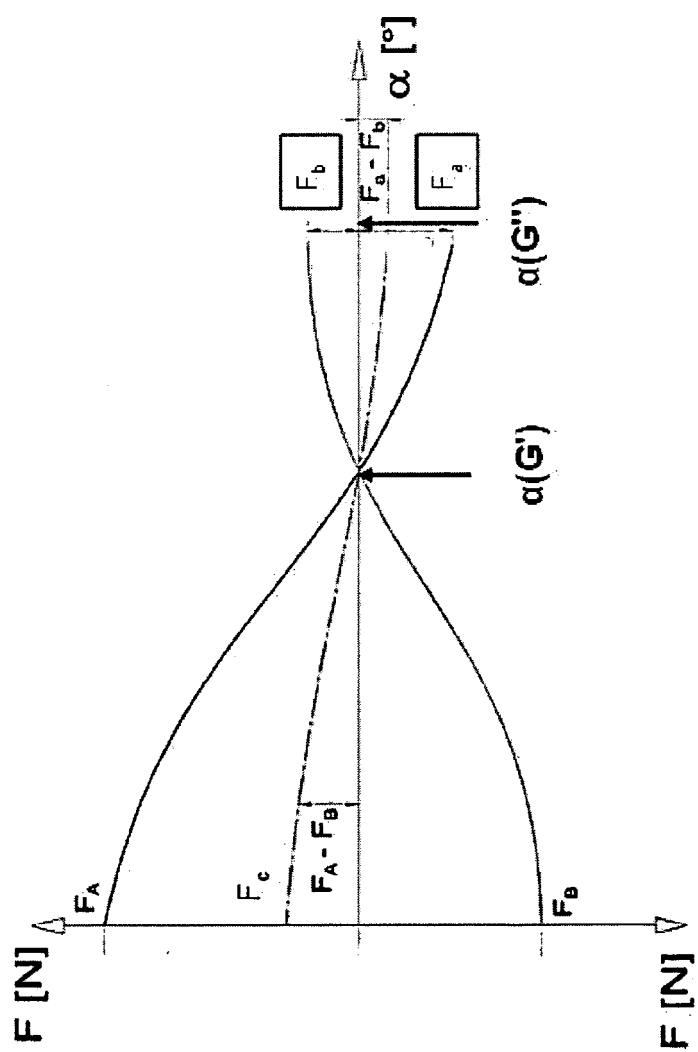


Fig.3

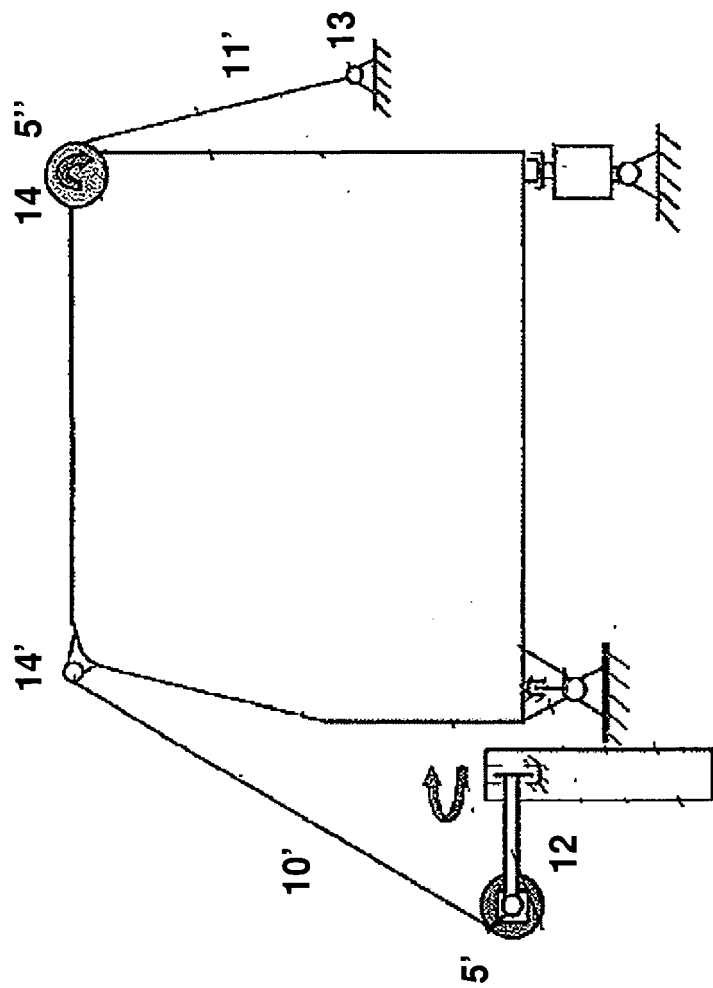


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5534

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Place of search Munich		Date of completion of the search 22 April 2010	Examiner Spinelli, Vito
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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